

A SURFACE DEFECT IN BLACK SHEEP SKINS

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A surface defect in black variety of Indian sheep skins probably caused by some biological factors is found responsible for considerable degradation in quality of leather. The defect appears as hairless patches in the back region of raw sheep skin which becomes prominent after unhairing as black pigmented area associated with slight grain damage along the line of backbone and finally results in severe grain damage or even perforation of the leathers. After dyeing, the leathers take deeper shade in the affected areas. Histopathological changes in the affected area of the skin have been studied.

Alkaline swelling of the skin is found to be uninfluenced, but the Ts of raw collagen fibres has increased by about 3°C compared to the unaffected areas. SATRA grain crack values and other physical properties of chrome tanned leather are appreciably affected by this defect.

Introduction

A small percentage of sheep skins available in Tamilnadu is affected in quality due to a surface defect, whose aetiological agent is not certainly known. This defect is generally classified in the trade along with mange infested skins. The black variety of sheep (known as 'Trichy black' breed in Tamilnadu) and are available in plenty in the northern and southern parts of Karnataka and Maharashtra states, is susceptible to this defect though some of the affected skins have brownish patches at the edges. About 50% or more of the skins obtained from black sheep is said to be deteriorated in quality to different degrees. Such defective skins are available throughout the year but in Tamilnadu, the incidence is comparatively higher during the months of August and September. The defect is generally noted in adult sheep mostly

in ewes. Such affected skins show hairless patches along the backbone extending from the mid thoracic to sacral region. In extensive cases, the grain in the affected area appears cracky over the backbone line and sometimes the grain is peeled off. Such a defect, though well recognised by sheep skin tanners, has not been reported so far. In the present investigation an attempt has been made to throw some light on this defect and its influence on the quality of finished leather.

Materials and methods

Fresh, wet salted sheep skins with the above defect were collected from different sources and were taken for study.

To prepare sections for histopathological study, skin samples (1 sq. cm.) were cut out from the affected area, fixed and then embedded in paraffin. 5 μ sections were cut and

stained with Haematoxylin and Eosin for general morphology and by Masson's Fontanna method for staining melanin pigment. Sections were also stained with methylene blue (0.5% aqueous solution) to find out the presence of bacteria.

Hydrothermal stability (T_s) of raw collagen fibres from affected and unaffected areas of skin was determined using microshrinkage meter and is expressed as $^{\circ}\text{C}$.

In order to study alkaline swelling, skin samples from the affected and unaffected areas of skin were cut out, weighed and treated in a wide mouthed stoppered bottle with 10% $\text{Ca}(\text{OH})_2$ solution for a period of 120 hr. During treatment, the samples were handled twice a day and after treatment they were taken out and washed with water to remove surface lime. The samples were then cut into small pieces and then dried at 100°C till constant weight. Swelling was determined from the increase in skin weight and expressed as percent swelling calculated on moisture free basis.

The sheep skins were processed into dyed chrome crust leathers according to a conventional method and they were examined visually in the raw stage, after liming and in chrome crust stage for any change in the affected area.

Physical properties of the leather e.g., tensile strength, elongation, stitch tear resistance and tongue tear resistance were determined by Scott tensile strength tester. SATRA grain crack values were determined by a Lastometer.

Results

Histopathology

The epidermis was atrophic and the epithelial cells were present only in two layers.

The retepegs were found to disappear. The collagen fibres were dense and ran horizontally. Elastic fibres were absent. Inflammatory changes in the dermis, as well as, in the epidermis were not observed. There was no indication of bacterial infection in the affected area of the skins.

Melanin pigment granules appeared dark brown when stained by Masson's Fontanna method and they were found to be scattered in the basal layers of the epidermis and also in the dermis.

Hydrothermal stability of collagen fibres

The hydrothermal stability of about 30 collagen fibres obtained from each of the affected and unaffected areas were determined. The average T_s of the affected collagen fibres was found to be 63°C compared to 60°C in the unaffected fibres.

Alkaline swelling of skin

Data on alkaline swelling of the affected and unaffected areas of skin are presented in Table 1.

TABLE 1
Alkaline swelling of sheep skin in the affected and unaffected areas.
(Moisture free basis.)

Period of alkaline treatment (hr)	Percent swelling	
	Unaffected	Affected
24	626.9	633.3
48	634.6	645.2
72	664.1	667.1
96	679.4	691.6
120	679.4	689.2

Observations on the defect in different stages of processing

a) *Raw skin*: The defect was clearly visible on the grain side of the skin from the

absence of hair in affected area (Fig. 1) which extended from lower third of shoulder region to the butt region. The affected areas were about 25-35 cm. in length extending laterally to 5-9 cm. on either side of the midline. They were black in appearance and somewhat rough to feel. On the flesh side of the skin no sign of the defect was apparently noted. When exposed against bright light the affected area appeared darker in colour on the flesh side.

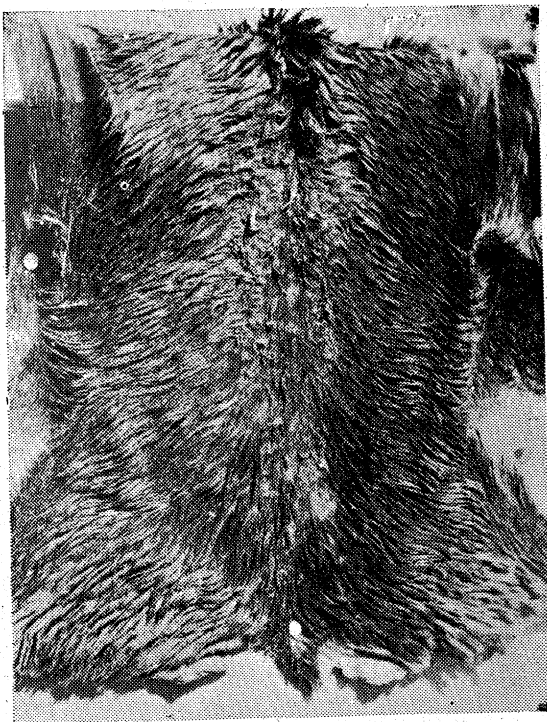


Fig. 1 : Black sheep skin showing alopecia in the backbone area.

b) Limed pelt : After liming and unhairing, the affected area was clearly visible on the grain side as a black patch on the back region which corresponded to the spinous processes of thoracic, lumbar, sacral and coccygeal vertebrae and transverse process of lumbar vertebrae (Fig 2). The grain over the affected

area, especially along the midline, could easily be peeled off. Affected area was slightly stiff when compared to the normal area.

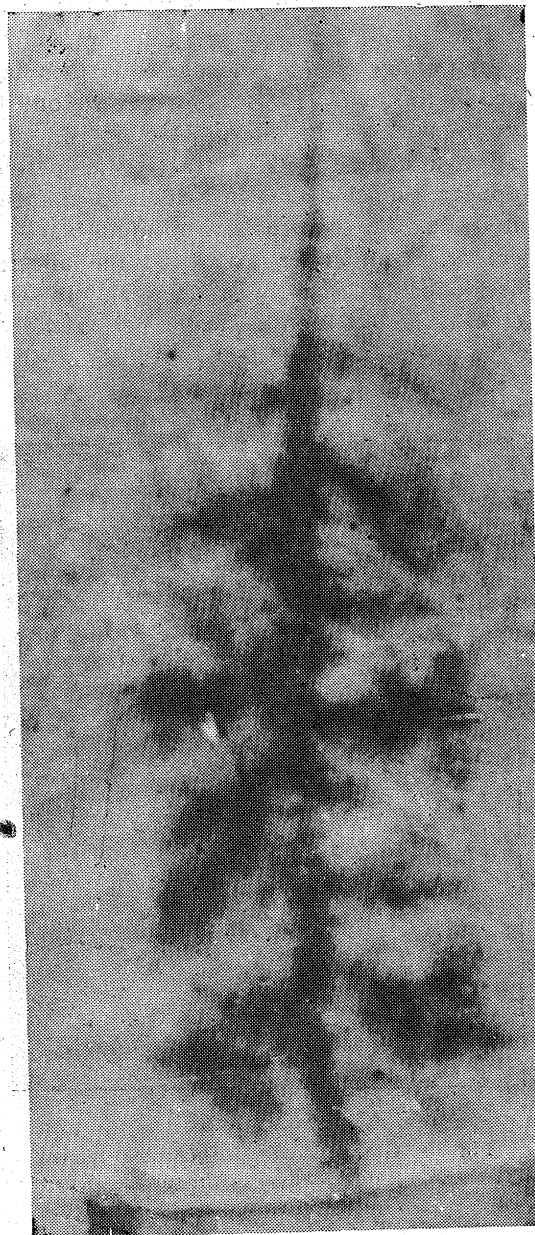


Fig. 2 : Hyperpigmentation in the affected area of black sheep skin after liming and unhairing.

No visible change was noted on the flesh side except that the pigmented area could easily be distinguished from the unaffected area when viewed against light.

c) *Chrome crust*: Damage to leather caused by this defect was quite severe on the grain side of chrome crust (Fig.3). The affected area in its characteristic pattern appeared much deeper in shade though prior to dyeing the same area appeared black in colour. Leather was cracky in the affected area and was slightly stiff to feel. In some cases the defect even led to the perforation.

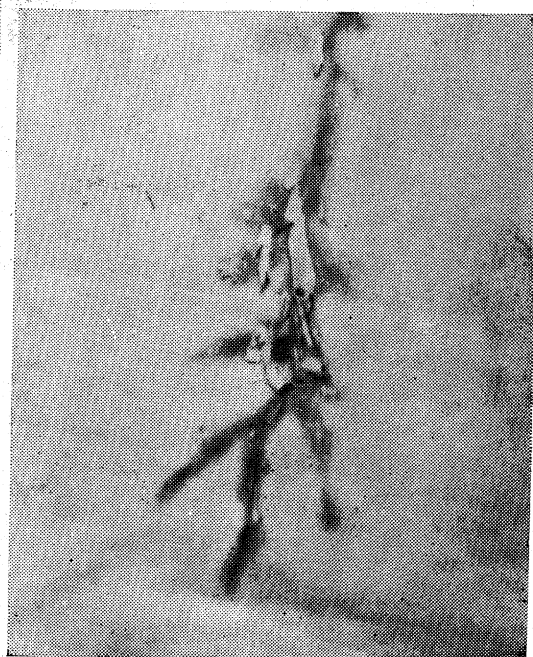


Fig. 3: Grain damage to chrome tanned leather caused by the surface defect in black sheep skin.

On the flesh side, the leather appeared slightly deeper in shade corresponding to the

more affected areas on the grain side. This variation in shade could, however, be eliminated when dyed black.

Physical properties of leather

Physical properties of the leather were determined and the results obtained are presented in Table 2

TABLE 2

Certain physical properties of chrome tanned sheep skins in the affected and unaffected areas
(Average of 10 samples)

	Unaffected	Affected
Tensile strength (Kg/cm thickness)	156.74	109.19
Elongation (%)	51.0	26.5
Stitch tear resistance (Kg/cm thickness)	213.70	77.46
Tongue tear resistance (Kg/cm thickness)	18.99	11.16

SATRA grain crack values of chrome tanned sheep skins were also determined and data obtained are presented in Table 3.

Extent of skin area affected due to hyperpigmentation

The total area of each sheep skin affected by hyperpigmentation was measured in cm² in the crust stage by an area measuring machine. After marking the affected area in the form of a square or rectangle, the extent of area damaged was measured and expressed as percent of total leather area. Results obtained are tabulated in Table 4.

TABLE 3

Satra grain crack values for chrome tanned sheep skins

Sample No.	Unaffected				Affected				Grain crack resistance (Kg/cm. thickness)		Bursting (Kg/Cm.	rsistance. thickness)
	Grain crack		Bursting		Grain crack		Bursting		Unaffected	Affected	Unaffected	Affected
	D	L	D	L	D	L	D	L				
1.	9.55	18	10.68	22	8.35	12	8.85	14	257.1	171.4	314.2	200.0
2.	9.47	22	9.50	24	8.35	12	8.55	14	275.0	150.0	300.0	175.0
3.	9.40	18	10.25	26	7.07	14	7.17	16	180.0	175.0	260.0	200.0
4.	10.24	18	11.14	22	7.07	16	7.20	18	163.6	133.3	200.0	150.0
5.	9.50	18	10.20	22	7.20	14	7.35	16	180.0	140.0	220.0	160.0
6.	8.72	14	9.43	16	5.64	4	7.06	6	140.0	36.3	160.0	54.5
7.	8.88	14	9.69	18	8.35	12	8.50	14	233.3	171.4	300.0	200.0
8.	9.55	18	10.68	22	7.72	16	8.23	18	360.0	200.0	446.0	225.0
9.	9.40	18	9.50	24	8.35	12	8.40	14	257.1	171.4	342.0	200.0
10.	9.47	20	10.70	24	8.25	14	8.35	16	250.0	175.0	300.0	200.0
Average	9.42	17.8	10.17	22.0	7.63	12.6	7.99	14.6	229.6	152.4	284.2	156.5

D = Distension in mm.
L = Load in Kg.

Grain crack distension value
6.0 mm and below = sub-standard
7.0 mm = satisfactory
8.0 mm and above = very good.

TABLE 4

Leather* area damaged due to hyperpigmentation

	Area affected	
	(cm) ²	(%)
a) Maximum	800	20.7
b) Minimum	408	7.7
c) Average	543	14.5

*No. of leather samples examined - 12

Discussion

Histological study of the skin sections from the affected area shows that atrophic changes have taken place and the epidermis has been thinned out having only the basal layer. Proliferation of collagen fibres has been noted and the fibres are found to run horizontally. Elastic fibres are found absent. The above observations indicate that scleroderma type of changes² have taken place in the affected areas. The occurrence of hyperpigmentation (melanosis) is due to the presence of melamin pigment.

T_s of raw skin collagen from the affected area is found to be higher by about 3°C from that of unaffected area. It is, however, difficult to explain the slight increase in T_s in the affected fibres with the available data but on the other hand, it can be said that crosslinkings in collagen fibres are not adversely affected by this defect. Alkaline swelling of skin is found to be uninfluenced by this defect though in some earlier studies³ with other skin defects this was found to be increased in the affected areas.

This defect is clearly visible on the hair side of raw skin which apparently looks like 'hair-slip' without having any scab formation as in the case of mange infested skins. Loss of hair may be due to cutaneous lesions or

manifestation of systemic disorder eg. endocrine disturbances which may be subsequently followed by hyperpigmentation as has been reported in the case of dogs.¹ Acquired hyperpigmentation⁴ in other animals was reported to occur after recovery from inflammatory skin diseases, X-ray irradiation, excess of iron and arsenic, deficiency of vitamin A, C, niacin, pantothenic acid, trace metals and amino acids etc., but in the case of sheep such observations have not been recorded so far, and thus further investigations are required to throw light on this aspect. Hyperpigmentation becomes prominent in the affected backbone area after liming and unhairing. The deteriorating effect of this defect on skin can be noted in this stage from the detachability and crackiness of the grain in the affected area. But the severity of the defect becomes apparent in chrome crust stage where the grain is found to be entirely removed or detached in the affected area. When folded, the leather is found to crack easily along the line of backbone. In dyed leather, the affected area on the grain appears to give a darker shade. In some skins, this defect has caused holes in severely affected areas.

It may be noted from Table 2 that physical properties of leather are greatly affected by this surface defect. Very low elongation values in the affected areas point out that the leathers have considerably lost the elastic property in those areas.

It is apparent from Table 3 that the grain crack distension values for all the unaffected samples are very good (average 9.24) whereas the average value (7.63) for the affected areas is satisfactory. The average distension value for bursting is also considerably affected by this defect. The load applied for both grain crack and bursting is significantly low in the affected areas which indicates that the leathers have become considerably weak in the affected areas. The grain crack resistance

and bursting resistance values in addition suggest that leathers in the affected areas have become cracky and burst easily compared to those from unaffected areas.

It may be noted from Table 4 that about 14.5 percent of leather area is affected on an average. Besides, the best part of the leather i. e., the butt area is affected by this defect.

It is thus apparent from the above studies that such affected leathers are unsuitable for any type of grain finish but skins with mild damage may probably be used as lining leathers.

The black variety of sheep skins fetch very low price compared to red hairy sheep skins and considering the low leather making potentiality of such skins, it is warranted that some thorough studies are to be made to identify the breed and its distribution as black variety of sheep may occur in different breeds. The basic factors responsible for the hyperpigmentation and

related degradation in skin quality should be determined. Such investigations will help in suggesting the preventive measures, if any, otherwise elimination of the breed or breeds involved may be the only alternative.

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REFERENCES

1. Bancroft J. D. & Stevens, A., *Histopathological stains and their diagnostic uses*, Churchill Livingstone, Edinburgh, London, 1975.
2. Jones J.E.T., *Vet. Rec.*, **70**, 175 (1958)
3. Nedunchellian, S., Surgumar, M. & Nandy S.C., *Leather Sci.*, **25**, 457 (1978).
4. Karl, F. & Schwartzman, R. M., *Veterinary and Comparative Dermatology*, J. B. Lippincott & Co., Philadelphia, 1964.